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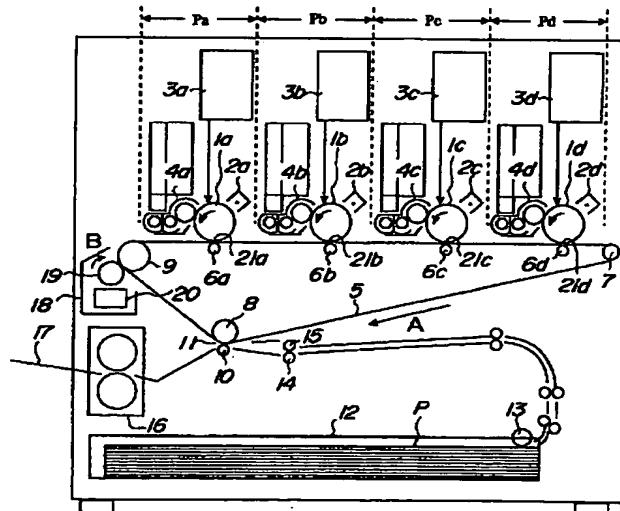
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(54) [発明の名称] 画像形成装置

(57) 【要約】

【課題】 中間転写体を用いる場合であったも専用のクリーニング機構を設ける必要がなく、かつ中間転写体への負荷トルクを高くすることもない画像形成装置を提供する。

【解決手段】 中間転写体5上に残留したトナーに対して現像手段により現像されるときとは逆極性の帶電を有するように帶電を施す転写残トナー帶電手段18を、二次転写手段10よりも中間転写体5の移動方向下流側であつて一次転写手段6よりも上流側に配設し、中間転写体5へトナー像を一次転写した後に像担持体1に残留した転写残トナーを現像手段3で回収するとともに、記録材Pへトナー像を二次転写した後に中間転写体5に残留した転写残トナーを転写残トナー帶電手段18及び一次転写手段6による帶電によって像担持体1に逆転写し、更に現像手段3で回収することを特徴とする。



【特許請求の範囲】

【請求項1】並列された複数の像担持体の表面を帯電手段により帯電し、選択露光して形成した潜像を現像手段によりトナー現像し、該トナー像を一次転写手段によって移動する中間転写体に順次転写する複数の画像形成手段と、前記中間転写体に転写されたトナー像を搬送される記録材に転写する二次転写手段とを有する画像形成装置において、

前記中間転写体上に残留したトナーに対して前記現像手段により現像されるときは逆極性の帯電を有するよう帯電を施す転写残トナー帯電手段を、前記二次転写手段よりも前記中間転写体の移動方向下流側であって前記一次転写手段よりも上流側に配設し、

前記中間転写体へトナー像を一次転写した後に前記像担持体に残留した転写残トナーを前記現像手段で回収するとともに、前記記録材へトナー像を二次転写した後に前記中間転写体に残留した転写残トナーを前記転写残トナー帯電手段及び一次転写手段による帯電によって前記像担持体に逆転写し、更に前記現像手段で回収することを特徴とする画像形成装置。

【請求項2】前記像担持体の表面を帯電する帯電手段は、注入帯電手段であることを特徴とする請求項1記載の画像形成装置。

【請求項3】前記中間転写体に残留したトナーに帯電を施す一次転写手段は、中間転写体に対して最初にトナー像を転写する画像形成手段における一次転写手段であることを特徴とする請求項1記載の画像形成装置。

【請求項4】前記中間転写体に対して最初にトナー像を転写する画像形成手段は、ブラックトナー像を転写するものであることを特徴とする請求項3記載の画像形成装置。

【請求項5】前記トナー像の形成に用いられるトナーは重合法により作成されたトナーであることを特徴とする請求項1乃至請求項4のいずれかに記載の画像形成装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は複写機やプリンタ、ファクシミリ装置等の画像形成装置に関し、更に詳しくは複数の像担持体と中間転写体を用いるとともに、現像と同時に残留トナーをクリーニングする画像形成装置に関するものである。

【0002】

【従来の技術】近年、電子写真装置等の画像形成装置は小型化、高機能化、カラー化が進められてきているが、他方では信頼性の向上、システム展開、メンテナンスフリー、人や環境に優しいといった要求が高まってきており、それらの要求を満たすべく様々な画像出力装置が提案されてきている。

【0003】最近では特に装置全体の小型化、廃トナー

レスによるエコロジー対応、感光体ドラムの長寿命化、1ページ当たりのトナー消費量の削減のため、現像手段に、記録材に対するトナー画像転写後の感光体ドラム面に残留しているトナーのクリーニング手段を兼用させることで、専用機器としてのクリーニング手段の配設をなくした「現像同時クリーニング」または「クリーナーレス」と呼ばれる（以下、これらを「クリーナーレスシステム」という）画像形成装置も出現している（特開昭59-133573号公報、同62-203182号公報、同63-133179号公報、同64-20587号公報、特開平2-51168号公報、同2-302772号公報、同5-2287号公報、同5-2289号公報、同5-53482号公報、同5-61383号公報等）。

【0004】クリーナーレスシステムは転写部から現像部へ感光体ドラム上の転写残余トナーを移行させ、それを現像手段のトナー担持体（トナー供給体、現像部材）にて次工程以降の現像時にトナー担持体に印加する直流電圧と感光体ドラム表面電位間の電位差である、かぶり取り電位差によって回収するものである。

【0005】これによれば、専用機としてのクリーニング装置がなくとも、転写残余トナーは現像手段にて回収されて次工程以降の現像に用いられるため、廃トナーをなくすことができる。また専用機器としてのクリーニング装置の配設がないので、スペースの面での利点も大きく、装置を大幅に小型化できるようになる。

【0006】上記のクリーナーレスシステムは、重合法において生成された球形状のトナーを用いることによって良好な結果が得られることが判明している。重合法によって生成された球形状のトナーの場合、感光体ドラムに対する鏡影力、ファンデルワールス力等の付着力が小さくなり、転写工程における転写残トナーが少なく、かつ、現像同時クリーニング時のトナーの回収効率が大きくなるため、クリーナーレスシステムに対して有利となる。

【0007】そして、装置全体の小型化、廃トナーレスによるエコロジー対応、感光体ドラムの長寿命化、1ページ当たりのトナー消費量の削減を考慮してクリーナーレスシステムを採用した画像形成装置においてもカラー化、高速化のために複数の感光体ドラムを備え、中間転写体に順次トナー画像を多重転写することでカラー画像を高速に得るようにしたカラー画像形成装置の出現が待望されている。

【0008】

【発明が解決しようとする課題】しかしながら、上記構成のような感光体ドラム上の転写残トナーを、例えば現像器で回収するクリーナーレスシステムを用いた画像形成ユニットを複数有し、かつ中間転写方式を採用した画像形成装置において、クリーニングブレード方式の中間転写体クリーナーを用いた場合、中間転写体に対して過剰な負荷がかかり、中間転写体を駆動するトルクが高くなるという問題がある。

【0009】中間転写体への負荷トルクが高くなると、中間転写体の移動速度が不安定になり、レジストレーションが乱れるといった画像不良や、手前側、奥側の負荷トルクにアンバランスが生じた場合、中間転写体が主走査方向に寄る時の力が大きくなりすぎて中間転写体の駆動ができなくなるおそれがあった。

【0010】このような問題は、特にトナーとして重合法により生成した球形状のトナーを用いた場合に、十分な中間転写体のクリーニングを行おうとすると、中間転写体クリーナーのクリーニングブレード圧力を大きく設定する必要があるためより顕著な問題となっていた。

【0011】また、中間転写体にクリーニング機構を設け、二次転写残トナーを回収、廃棄するような構成では、折角、感光体ドラム周りにおいて、クリーナーレスシステムを採用しても、装置全体でのクリーナーレスとはなり得ず、エコロジーという観点からは不十分なものであった。

【0012】本発明は上記課題を解決するものであり、その目的は、中間転写体を用いる場合であったも専用のクリーニング機構を設ける必要がなく、かつ中間転写体への負荷トルクを高くすることもない画像形成装置を提供するものである。

【0013】

【課題を解決するための手段】上記目的を達成するための本発明に係る代表的な構成は、並列された複数の像担持体の表面を帯電手段により帯電し、選択露光して形成した潜像を現像手段によりトナー現像し、該トナー像を一次転写手段によって移動する中間転写体に順次転写する複数の画像形成手段と、前記中間転写体に転写されたトナー像を搬送される記録材に転写する二次転写手段とを有する画像形成装置において、前記中間転写体上に残留したトナーに対して前記現像手段により現像されるときとは逆極性の帯電を有するように帯電を施す転写残トナー帯電手段を、前記二次転写手段よりも前記中間転写体の移動方向下流側であって前記一次転写手段よりも上流側に配設し、前記中間転写体へトナー像を一次転写した後に前記像担持体に残留した転写残トナーを前記現像手段で回収するとともに、前記記録材へトナー像を二次転写した後に前記中間転写体に残留した転写残トナーを前記転写残トナー帯電手段及び一次転写手段による帯電によって前記像担持体に逆転写し、更に前記現像手段で回収することを特徴とする。

【0014】上記構成にあっては、中間転写方式を採用した画像形成装置において、中間転写体クリーナーとしてクリーニングブレード方式を用いずに二次転写残トナーに対し、現像時とは逆極性のトリボを有するように帯電を行い、中間転写体から像担持体に対して逆転写を行い、現像手段で回収する。このため、中間転写体に対して過剰な負荷がかかり、中間転写体を駆動するトルクが高くなるという問題や、中間転写体への負荷トルクが高

くなつて、中間転写体の移動速度が不安定になりレジストレーションが乱れるといった画像不良や、手前側、奥側の負荷トルクにアンバランスが生じた場合、中間転写体が主走査方向に寄る時の力が大きくなりすぎて中間転写体の駆動ができなくなるという問題を防止することが可能となる。

【0015】

【発明の実施の形態】次に本発明の一実施形態に係る画像形成装置について、図面を参照して説明する。

【0016】【第1実施形態】図1乃至図3を参照して第1実施形態について説明する。尚、図1は画像形成装置の概略構成説明図であり、図2はトナーの形状係数の説明図、図3はトナーの構造説明図である。

【0017】ここでは、まず画像形成装置の全体構成について説明し、次に中間転写体のクリーニング構成について説明する。

【0018】【画像形成装置の全体構成】この画像形成装置は、図1に示すように、画像形成手段としての複数の画像形成ユニットPa, Pb, Pc, Pdが中間転写体としての中間転写ベルト5の上行側ベルト部分の上側において、該ベルト部分の移動方向にそつて順次配列して配設してある。

【0019】各画像形成ユニットPa, Pb, Pc, Pdにおいて像担持体としての各感光体ドラム1a, 1b, 1c, 1d面にはフルカラー画像の色分解成分画像としての、ブラック画像、シアン画像、イエロー画像、マゼンタ画像の形成がなされる。

【0020】本実施形態では、各画像形成ユニットPa, Pb, Pc, Pdにおいて、それぞれ、像担持体としての感光体ドラム1a, 1b, 1c, 1dと該感光体ドラムを均一に帯電処理する帯電手段2a, 2b, 2c, 2dと感光体ドラムの帯電処理面に静電潜像を形成する画像露光手段3a, 3b, 3c, 3dと、形成された静電潜像をトナー粒子で現像する現像手段4a, 4b, 4c, 4dを有したクリーナレスの画像形成ユニットである。

【0021】上記画像形成ユニットで各色トナー像を形成し、そのトナー像を感光体ドラムに接触して回転する中間転写ベルト5に対し、一次転写ローラ6a, 6b, 6c, 6dへのバイアス印加によって順次転写し、さらに中間転写ベルト5に転写されたトナー像を記録材に二次転写してカラー画像を得るものである。

【0022】(像担持体) 上記の各画像形成ユニットPa, Pb, Pc, Pdにおいて感光体ドラム1a, 1b, 1c, 1dは本実施形態では直径30mm、長さ300mmのOPC感光体であり、100mm/secのプロセススピード(周速度)をもつて矢印の時計回り方向に回転駆動される。

【0023】本実施形態の装置における像担持体としての感光体ドラムは、アルミニウム製の導電性ドラム基体

(アルミ基体)とその周面に第1層から第4層の4つの層を順次に形成した感光体層からなる。

【0024】ここで、第1層は下引き層であり、アルミ基体の欠陥をなさるために設けられている厚さ20μmの導電層である。

【0025】第2層は正電荷注入防止層であり、アルミ基体から注入された正電荷が感光体表面に帯電された負電荷を打ち消すのを防止する役割を果たし、アミラン樹脂とメトキシメチル化ナイロンによって $10^6 \Omega \cdot \text{cm}$ 程度に抵抗調整された厚さ1μmの中間層である。

【0026】第3層は電荷発生層であり、ジスアゾ系の顔料を樹脂に分散した厚さ約0.3μmの層で、露光を受けることによって正負の電荷対を発生する。

【0027】第4層は電荷稿送層であり、ポリカーボネイト樹脂にヒドラゾンを分散したものであり、P型半導体である。従って感光体表面に帯電された負電荷はこの層を移動することができず電荷発生層で発生した正電荷のみを感光体表面に輸送することができる。

【0028】(帯電手段) 帯電手段2a, 2b, 2c, 2dは本実施形態ではコロトロンタイプのコロナ帯電器を用いている。このコロナ帯電器により感光体ドラム1a, 1b, 1c, 1d表面を略-700Vに一様に帯電させようとしている。

【0029】(露光手段) 画像露光手段3a, 3b, 3c, 3dは本実施形態では光路長を必要とせず装置の小型化に有利な固体スキャナーとしてLEDアレイを用いた。このLEDアレイ3a, 3b, 3c, 3dの個々のLEDが不図示の画像読み取り装置から入力した原稿画像情報の時系列電気デジタル画素信号に対応して明滅(ON/OFF)制御されることにより、回転する感光体ドラム1a, 1b, 1c, 1dの帯電処理面に対して画像露光がなされ、感光体ドラム1a, 1b, 1c, 1d面の露光明部の表面電位が減衰して静電潜像が形成される。

【0030】(現像手段) 現像手段4a, 4b, 4c, 4dは本実施形態では2成分磁気ブラシ反転現像装置(現像器)を用いている。現像装置の概略構成としては、現像スリーブ、現像スリーブ内に固定配置されたマグネットローラ、現像剤を現像スリーブ表面に薄層形成するために配置された規制ブレード、非磁性のトナー粒子と磁性のキャリア粒子の混合物を収容する現像容器等から構成される。

【0031】ブラック用の画像形成ユニットPaにおける現像手段4aにはブラックトナーを収容させており、感光体ドラム1a面に形成されたブラック画像に対応する静電潜像をブラック画像として反転現像する。同様に画像形成ユニットPbにおける現像手段4bにはシアントナーを収納し、画像形成ユニットPcにおける現像手段4cにはイエロートナーを収納し、画像形成ユニットPdにおける現像手段4dにはマゼンタトナーを収納してブラックトナーの場合と同様の方法で反転現像を行う。

【0032】(トナー) 本実施形態に用いたトナーは、例えば懸濁重合法で製造された低軟化物質を5~30重量%含み、形状係数SF1が100~120、形状係数SF2が100~120、粒径が5~7μmの実質的球形である非磁性微粒径重合トナーである。

【0033】トナーの形状が球形に限りなく近づくと、転写効率が高くなると言われている。これは、個々のトナーの表面エネルギーが小さくなつて、流動性が高まり、感光体ドラムなどに対する吸着力(鏡映力)が弱まって、転写電界の影響が受けやすくなるためと考えられる。

【0034】尚、ここでいう形状係数SF1とは、図2(a)に示すように、球状物質の形状の丸さの割合を示す値であり、球状物質を二次元平面上に投影してできる梢円状図形の最大長L_{max}の2乗を図形面積Sで割って、 $100\pi/4$ を乗じた時の値で表される。つまり形状係数SF1は、

$$SF1 = (L_{max}^2/S) \times (100\pi/4)$$

【0036】で定義されるものである。

【0037】形状係数SF2は、図2(b)に示すように、物質の形状の凹凸の割合を示す数値であり、物質を二次元平面上に投影してできる図形の周長L_pの2乗を図形面積Sで割って、 $100\pi/4$ を乗じた時の値で表される。つまり形状係数SF2は次式、

$$SF2 = (L_p^2/S) \times (100\pi/4)$$

【0039】で定義されるものである。

【0040】尚、本実施形態では日立製作所製FE-SEM(S-800)を用い、トナー像を100回無作為にサンプリングし、その画像情報は、インターフェースを介して、ニコレ社製画像解析装置(LUSEX3)に導入して解析を行い、上式より算出したものである。

【0041】上記重合トナーの概略構成図を図3に示す。図3に示すように、重合トナーtは、その製造法上球形となる。本実施形態ではコアt1にエスチル系ワックスを内包し、樹脂層t2にスチレン-ブチルアクリレート、表層t3にスチレン-ポリエスチルという構成の重合トナーを用いた。その比重は約1.05である。3層構成となっている理由は、コアt1にワックスを内包することで、定着工程でのオフセット防止効果が得られ、また表層t3に樹脂層を設けることによって帯電効率のアップを図っているためで、また実際に使用時には、トリボ安定化のためにオイル処理したシリカを外添している。

【0042】尚、本実施形態で使用した、上記トナーのトリボ(Q/M)はおよそ-30mC/kgである(Q:電荷量、M:質量)。

【0043】(中間転写体) 中間転写体としてのエンドレスベルト体(中間転写体ベルト)5は、各画像形成ユニットPa, Pb, Pc, Pdの下側において、該各画像形成ユニットの感光体ドラム1a, 1b, 1c, 1d

の下面間にわたらせて、駆動ローラ7、二次転写対向ローラ8、従動ローラ9の3本のローラに懸回張設しており、図1の矢印Aに示すように、の反時計回り方向に感光体ドラム1a, 1b, 1c, 1dと同じ周速度で回転駆動される。

【0044】前記中間転写ベルト5は、例えば、素材としてポリウレタン系樹脂、ポリエステル系樹脂、ポリスチレン系樹脂、ポリオレフィン系樹脂、ポリブタジエン系樹脂、ポリアミド系樹脂、ポリイミド系樹脂、ポリ塩化ビニル系樹脂、ポリエチレン系樹脂、フッ素系樹脂等に対して、導電性のカーボン粒子や金属粉等を分散させたものが用いられる。

【0045】本実施形態においては、ポリイミド系樹脂にカーボン粒子を分散させたものを用いた。そしてその体積抵抗値は 10^8 ~ 10^{16} Ω・mの範囲が望ましい。 10^7 Ω・m以下の中間転写体ベルト5を用いた場合には画像に、にじみ、太りが生じたり、画像比率の異なる画像形成時に転写効率が変化してしまったりという問題が生じ、 10^{17} Ω・m以上の中間転写体ベルト5を用いた場合にはトナー転写時に中間転写体ベルト5の電位が大きくなりすぎることにより、感光体ドラム1a, 1b, 1c, 1d、あるいは記録材Pとの間で異常放電が発生し、画像不良が発生する。そこで本実施形態においては、厚さ100μm、体積抵抗率約 10^{13} Ω・mのシームレスベルトを用いている。

【0046】(一次転写手段) 一次転写手段を構成する一次転写ローラ6a, 6b, 6c, 6dはそれぞれ中間転写ベルト5の内側に配設した第1から第4の4つのローラによって構成されている。

【0047】第1の一次転写ローラ6aはブラック用の画像形成ユニットPaの感光体ドラム1aの下面に中間転写体ベルト5の上行側ベルト部分を挟んで当接して一次転写部21aを形成している。第2の一次転写ローラ6bはシアン用の画像形成ユニットPbの感光体ドラム1bの下面に中間転写体ベルト5の上行側ベルト部分を挟んで当接して一次転写部21bを形成している。第3の一次転写ローラ6cはイエロー用の画像形成ユニットPcの感光体ドラム1cの下面に中間転写体ベルト5の上行側ベルト部分を挟んで当接して一次転写部21cを形成している。第4の一次転写ローラ6dはマゼンタ用の画像形成ユニットPdの感光体ドラム1dの下面に中間転写体ベルト5の上行側ベルト部分を挟んで当接して一次転写部21dを形成している。

【0048】各一次転写ローラ6a, 6b, 6c, 6dには、それぞれ不図示の転写バイアス電源からトナーとは逆極性の転写バイアスが印加され、これにより感光体ドラム1a, 1b, 1c, 1d面側のトナー画像が一次転写部21a, 21b, 21c, 21dにおいて中間転写体ベルト5の上行側ベルト面に静電的に転写される。

【0049】(画像記録手順) 本実施形態の装置の場合

は、まず、ブラック用の画像形成ユニットPaの一次転写部21aにおいて感光体ドラム1a面から中間転写体ベルト5の上行側ベルト面にブラック画像が転写される。ついで、シアン画像、イエロー画像、マゼンタ画像が同様の方法で中間転写体ベルト5の上行側ベルト面に重ねあわせるように転写されて、フルカラー画像が合成形成される。

【0050】上記のブラック用、シアン用、イエロー用、マゼンタ用の各画像形成ユニットPa, Pb, Pc, Pdにおいて、それぞれ現像装置3a, 3b, 3c, 3dは、感光体ドラム1a, 1b, 1c, 1d面から中間転写体ベルト5面に画像を転写した後の感光体ドラム1a, 1b, 1c, 1d面に残留した転写残トナーを除去するクリーニング手段を兼ねさせ、現像と同時にクリーニングするものであり、各画像形成ユニットPa, Pb, Pc, Pdのいずれにも専用機器としての感光体ドラムクリーニング器は具備させていない(クリーナレスシステム)。

【0051】そして、上記のようにしてフルカラー画像が形成された中間転写ベルト面は引き続く中間転写体ベルト5の回動で二次転写対向ローラ8と二次転写手段としての二次転写ローラ10によって形成される二次転写部11に至る。二次転写ローラ10は二次転写対向ローラ8に中間転写体ベルトを挟んで当接して二次転写部を形成しており、不図示の転写バイアス電源からトナーとは逆極性の転写バイアスが印加される。

【0052】12は給紙カセット、13は該給紙カセット12から記録材(転写材)Pを操り出す給紙ローラである。14, 15はレジストローラ対であり、前記給紙カセット12から給送された記録材Pを二次転写部11に所定のタイミングで給送する。

【0053】すなわち、中間転写体ベルト5の回動により該中間転写体ベルト面に形成されたフルカラー画像の先端部が二次転写部11に到達したとき、記録材Pが給送され、二次転写部11において中間転写体ベルト5面側のフルカラー画像が該給送記録材Pに対して一括転写される。

【0054】二次転写部11を出た記録材Pは中間転写体ベルト5面から分離され、定着ユニット16に導入された画像の熱定着を受け、画像形成物として装置外のトレイ17に排紙される。

【0055】また、二次転写時に中間転写体ベルト5面に残された転写残トナーは転写残トナー帶電装置18で中間転写体ベルト5面への転写時とは逆極性に帶電される。

【0056】(中間転写体のクリーニング構成) 次に前記トナー像を記録材Pに転写した後の中間転写体としての中間転写ベルト5のクリーニング構成について説明する。

【0057】本実施形態においては、中間転写ベルト5

に残留した転写残トナーを転写残トナー帯電手段及び一次転写手段による帯電によって感光体ドラム1aに逆転写し、更に現像手段4aで回収するものであり、そのために転写残トナー帯電手段が前記二次転写ローラ10よりも中間転写ベルト5の回転移動方向下流側であって前記一次転写ローラ6aよりも上流側に配設されている。

【0058】この転写残トナー帯電装置18はアクリルスポンジからなる低抵抗スponジ層と、アクリルウレタンからなる抵抗層、フッ素樹脂からなる表面離型層の3層構造を有した転写残トナー帯電手段19を有している。体積抵抗率は抵抗層で $10^7 \sim 10^{11} \Omega \cdot m$ 表面離型層で $10^{14} \sim 10^{18} \Omega \cdot m$ である。また、中間転写体ベルト5に対して総圧980~2940mN (100~300gf) で当接させられていて、図中矢印Bの方向、中間転写体ベルト5の回転方向に対してカウンター方向に回転させられている。この転写残トナー帯電手段19の当接圧は、従来のクリーニングブレードを直接中間転写ベルト5に当接させてクリーニングしていた場合に必要であった当接圧の1/3~1/20である。

【0059】また、転写残トナー帯電装置18は転写残トナー帯電手段19に高圧を印加するための高圧電源20も備えており、この高圧電源20からは現像されたトナーと逆極性でその絶対値が約1~3kV (電流値は絶対値で約5~40μA) のDCバイアスが出力されるよう構成される。出力するバイアスとしては、前述のようにDCバイアスのみでもよいがACバイアスを重畳すると転写残トナーのトリボを均一に再帯電する効果が高まるので好ましい。

【0060】本実施形態に係る中間転写ベルト5のクリーニングは、二次転写終了後の中間転写ベルト5の回転方向の最初の画像形成ユニットPaの感光体ドラム1aから中間転写ベルト5への一次転写と同時に中間転写ベルト5上の二次転写残トナーを感光体ドラム1aに逆転写して戻し、画像形成ユニットPaの現像手段4aにて回収するところに特徴を有する。

【0061】そのメカニズムを説明する。中間転写ベルト5上に形成されたトナー像は、このトナー像の帯電極性とは逆極性の二次転写バイアスによって形成される強力な電界により二次転写部11に送られた記録材Pに転写される。

【0062】この時、記録材Pに転写されずに中間転写ベルト5上に残留する二次転写残トナーは、正規の帯電極性とは逆極性に帯電されているものが多い。しかし、すべての二次転写残トナーが正規の帯電極性と逆極性に反転させられているわけではなく、中和されて電荷を持たないトナーや、正規の帯電極性 (本実施形態においては負極性) を維持しているトナーも一部存在する。このような二次転写残トナーに対して転写残トナー帯電装置18により、中間転写ベルト5上に残留する二次転写残トナーは、すべて正規の帯電極性とは逆極性 (本実施形態

においては正極性) に再帯電される。

【0063】次に、正規の帯電極性とは逆極性に再帯電された二次転写残トナーが最初の画像形成ユニットPaの一次転写部において、通常の転写工程と同じ転写帯電を受けると、中間転写ベルト上の転写残トナーは感光体ドラム側に逆転写され、中間転写ベルト5表面上は清掃されることとなる。

【0064】感光体ドラム側に逆転写された二次転写残トナーは画像形成ユニットPaの現像部において現像手段3aに回収され、現像手段3a内で再び正規の帯電極性に再帯電されて再利用されることとなる。

【0065】このとき、中間転写ベルト5上の二次転写残トナーはブラック、シアン、イエロー、マゼンタがそれぞれ存在しているので、シアン、イエロー、マゼンタの画像形成を行う画像形成ユニットの現像手段で回収されるとシアン、イエロー、マゼンタの色味が大きくそれで画像不良の原因となるが、本実施形態に示したように、ブラックの画像形成ユニットPaの現像器4aに回収させた場合、もともとブラック色は無彩色であり、多少他色のトナーがブラック現像器4aに混入してもほとんど目立たないため画像不良に至らない。

【0066】以上説明したように、上記の構成とすることで中間転写ベルトクリーナーによって中間転写ベルトに過剰な駆動負荷を発生させることができなくなるとともに、中間転写ベルトから記録材への二次転写時に発生する二次転写残トナーの再利用も可能となつたので完全なクリーナレスシステムの構築が可能となつた。

【0067】【第2実施形態】次に本発明の第2実施形態について図4を参照して説明する。尚、図4は第2実施形態における画像形成装置の概略構成説明図であり、前述した第1実施形態と同一部材には同一符号を付している。

【0068】図4に示すように、本実施形態においても前述した第1実施形態と同様、複数の画像形成ユニットPa, Pb, Pc, Pdが中間転写ベルト5の上行側ベルト部分の上側において、該ベルト部分の移動方向にそって順次配列して配設した構成となっている。そして、各画像形成ユニットPa, Pb, Pdにおいて各感光体ドラム101a, 101b, 101c, 101d面にはフルカラー画像の色分解成分画像としての、ブラック画像、シアン画像、イエロー画像、マゼンタ画像の形成が中間転写ベルト5の回転移動方向上流側から順になされる。

【0069】また、本実施形態においても、各画像形成ユニットPa, Pb, Pdにおいて、それぞれ、像担持体としての感光体ドラム101a, 101b, 101c, 101dと該感光体ドラムを均一に帯電処理する帯電手段102a, 102b, 102c, 102dと感光体ドラムの帯電処理面に静電潜像を形成する画像露光手段3a, 3b, 3c, 3dと、形成された静電潜像をトナー粒子で現像する現像手段4a, 4b, 4c, 4dを有したクリーナレス

の画像形成ユニットである。

【0070】ただし、本実施形態においては感光体ドラムを帶電させる帶電手段が前述した第1実施形態において示したコロナ帯電手段とは異なり、オゾンレス、低電力消費、といった利点を有する接触帯電手段、接触帯電手段の中でも注入帯電方式の帶電手段を用いている。以下、第1実施形態と異なる部分について説明する。

【0071】上記の各画像形成ユニットP a, P b, P c, P dにおいて感光体ドラム101a, 101b, 101c, 101dは本実施形態においても直径30mm、長さ300mmのO P C感光体であり、100mm/secのプロセススピード（周速度）をもって矢印の時計方向に回転駆動されるが、後述するように層構成が前述の第1実施形態に用いた感光体とは異なっている。

【0072】すなわち、本実施形態の装置における像担持体としての感光体ドラム101a, 101b, 101c, 101dは、アルミニウム製の導電性ドラム基体（アルミ基体）と、その周面に下記の5つの層を順次に形成してなる感光体層からなる。第1から第4の層については前述の第1実施形態と同様である。そして、本実施形態では第5の層として電荷注入層を有している。

【0073】前記第5層の電荷注入層は、絶縁性樹脂のバインダーに導電性微粒子としてSnO₂超微粒子を分散した材料の塗工層である。具体的には、絶縁性樹脂に光透過性の導電フィラーであるアンチモンをドーピングして低抵抗化（導電化）した粒径0.03μmのSnO₂粒子を樹脂に対して70重量パーセント分散した材料の塗工層である。このようにして調合した塗工液をデイッピング塗工法、スプレー塗工法、ロールコート塗工法、ビームコート塗工法等の適当な塗工法にて厚さ3μmに塗工して電荷注入層としている。

【0074】あるいはシリコンの非晶質よりなる表面層を有する感光体（アモルファスシリコンドラム、a-Siドラム）も同様に用いられる。

【0075】被帶電体としての感光体は表面抵抗10¹¹～10¹⁶Ω・mの低抵抗層を有するものとすることができる。

【0076】また、本実施形態における帶電手段102a, 102b, 102c, 102dはスリーブ回転タイプの磁気ブラシ接触帶電部材である。

【0077】概略構成としては、S・N各々2極（磁束密度は各々1000ガウス程度）よりなる直径16mmの固定のマグネットローラと、このマグネットローラに回転自由に外嵌させた非磁性のSUS材からなるスリーブと、該スリーブの外周面にマグネットローラの磁力で付着保持させた磁性粒子の磁気ブラシ層からなる。

【0078】磁気ブラシ層を構成させる磁性粒子としては、平均粒径が10～100μm、飽和磁化が4～50A・m²/kg、抵抗が1×10⁴～1×10¹²Ω・mのものが望ましく、感光体ドラムにピンホールのような絶縁の欠陥が存在す

ることを考慮すると、1×10⁶Ω・cm以上のものを用いることが好ましい。磁性粒子の抵抗値は、底面積が228m²の金属セルに磁性粒子を2g入れた後、6.6kg/cm²で加重し、100Vに電圧を印加して測定している。

【0079】帶電性能をよくするにはできるだけ抵抗の小さいものを用いる方が良いので、本実施形態においては平均粒径25μm、飽和磁化40A・m²/kg、抵抗5×10⁸Ω・mのものを用い、これをスリーブの外周面に40g磁気付着させて磁気ブラシ層を形成させた。

【0080】磁性粒子の構成としては、樹脂中に磁性材料としてマグネットを分散し、導電化および抵抗調整のためにカーボンブラックを分散して形成した樹脂キャリア、あるいはフェライト等のマグネタイト単体表面を樹脂でコーティングし抵抗調整を行った物等が用いられている。

【0081】上記の磁気ブラシ接触帶電手段102a, 102b, 102c, 102dの磁気ブラシ層を感光体ドラム面に接触させて配設する。磁気ブラシ層と感光体ドラムの接触ニップ部の幅は6mmとしている。

【0082】そして、スリーブに不図示の帶電バイアス印加電源より所定の帶電バイアスVdcを印加し、スリーブを感光体ドラムとの接触ニップ部において感光体ドラムの回転方向とはカウンター方向（逆方向）となる時計回り方向に周速度150mm/secで回転駆動させることで、回転感光体ドラム面が帶電バイアスの印加された磁気ブラシ層で擦擦され、感光体ドラムの感光体層の表面が所望の電位に注入帶電方式で一様に一次帶電される。

【0083】前述した第1実施形態とは異なり、このような磁気ブラシ等の接触帶電部材を用いると、一次転写残トナーや二次転写残トナーが、いったん接触帶電部材に保持され、徐々に吐き出されて現像器にて回収されるようになるので、像露光時に感光体ドラム上に大量の転写残トナーが存在して次の画像形成に支障を来たしてしまうという問題を回避でき、また、現像器での回収がスムーズに行われるようになるので好ましい。

【0084】上記のような一次帶電手段として接触帶電、中でも注入帶電方式を用いた画像形成装置に中間転写体のクリーニング機構を適用することにより前述した第1実施形態と同じく、中間転写体クリーナーによって中間転写体に過剰な駆動負荷を発生させることがなくなるとともに、中間転写体から記録材への二次転写時に発生する二次転写残トナーの再利用も可能となり、完全なクリナーレスシステムの構築が可能となる。

【0085】

【発明の効果】本発明は前述のように、中間転写体に残留したトナーを現像手段に回収するようにしたために、中間転写体に対して過剰な負荷がかかり、中間転写体を駆動するトルクが高くなるという問題や、中間転写体への負荷トルクが高くなつて、中間転写体の移動速度が不安定になりレジストレーションが乱れるといった画像不

良や、手前側、奥側の負荷トルクにアンバランスが生じた場合、中間転写体が主走査方向に寄る時の力が大きくなりすぎて中間転写体の駆動ができなくなるという問題を防止することが可能となる。

【00-86】特に、トナーとして重合法により生成した球形状のトナーを用いた場合に、顕著な効果を得ることができ、さらには、二次転写残トナーをもブラック画像形成ユニットで回収、再利用するようにすることで、大きな画像弊害を発生させることなく完全なクリーナーレスシステムの構築が可能となった。

【図面の簡単な説明】

【図1】画像形成装置の概略構成説明図である。

【図2】トナーの形状係数の説明図である。

【図3】トナーの構造説明図である。

【図4】第2実施形態における画像形成装置の概略構成説明図である。

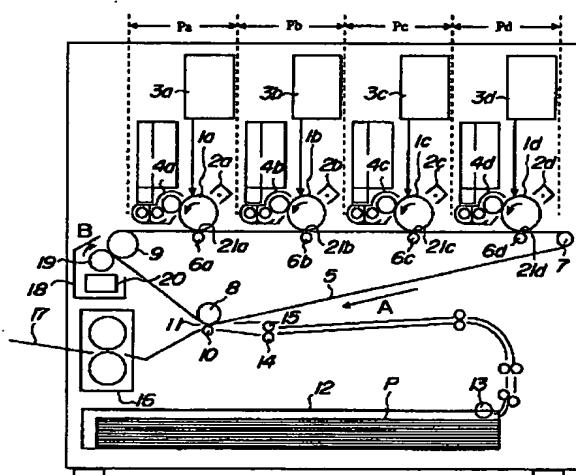
【符号の説明】

P …記録材

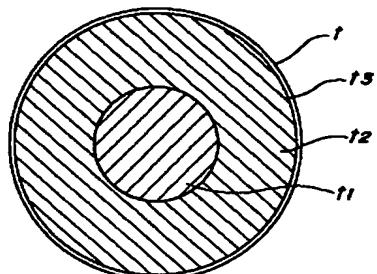
P_a, P_b, P_c, P_d …画像形成ユニット

- 1 a, 1 b, 1 c, 1 d …感光体ドラム
- 2 a, 2 b, 2 c, 2 d …帯電手段
- 3 a, 3 b, 3 c, 3 d …画像露光手段
- 4 a, 4 b, 4 c, 4 d …現像手段
- 5 …中間転写ベルト
- 6 a, 6 b, 6 c, 6 d …一次転写ローラ
- 7 …駆動ローラ
- 8 …二次転写対向ローラ
- 9 …従動ローラ
- 10 …二次転写ローラ
- 11 …二次転写部
- 12 …給紙カセット
- 13 …給紙ローラ
- 14, 15 …レジストローラ対
- 16 …定着ユニット
- 17 …トレイ
- 18 …転写残トナー帯電装置
- 19 …転写残トナー帯電手段
- 20 …高圧電源

【図1】

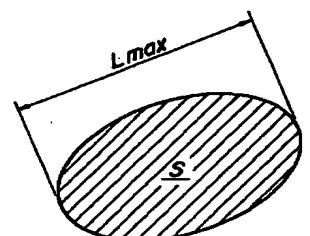


【図3】



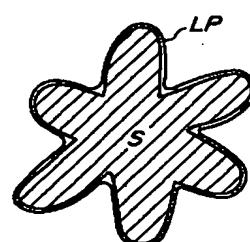
【図2】

(a)



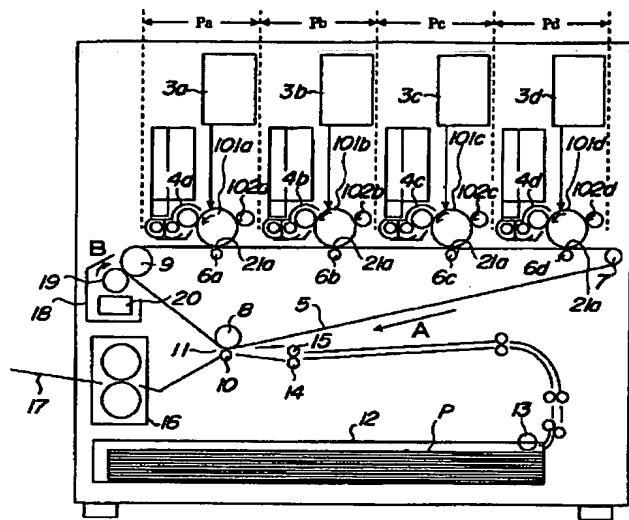
$$SF1 = \frac{L_{max}^2}{S} \times \frac{\pi}{4} \times 100$$

(b)



$$SF2 = \frac{LP^2}{S} \times \frac{\pi}{4} \times 100$$

【図4】



PATENT ABSTRACTS OF JAPAN

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G03G 15/01
G03G 15/16

(21)Application number : 11-293463

(71)Applicant : CANON INC

(22)Date of filing : 15.10.1999

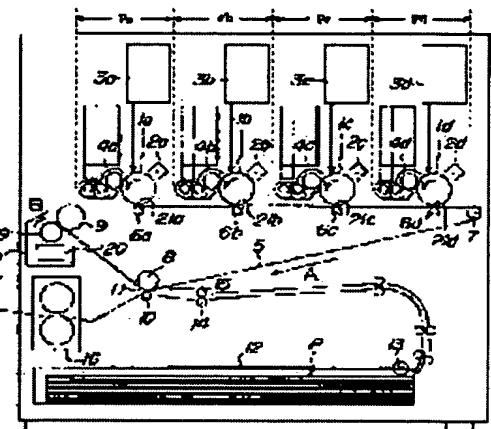
(72)Inventor : INOUE MASAHIRO

(54) IMAGE FORMING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an image forming device, with which it is not necessary to provide a dedicated cleaning mechanism even in the case of using an intermediate transfer body and the torque of load to the intermediate transfer body is not increased, either.

SOLUTION: A residual transfer toner charging means 18 for charging a toner remaining on an intermediate transfer body 5 so as to have charging of a polarity opposite to the case of developing due to a developing means is arranged downstream in the moving direction of the intermediate transfer body 5 from a secondary transfer means 10 and upstream from a primary transfer means 6, after the primary transfer of a toner image to the intermediate transfer body 5, the residual transfer toner on an image carrier 1 is collected by a developing means 3 and after the secondary transfer of the toner image to a recording material P, the residual transfer toner on the intermediate transfer body 5 is inversely transferred to the image carrier 1 by charging due to the residual transfer toner charging means 18 and the primary transfer means 6 and further collected by the developing means 3.



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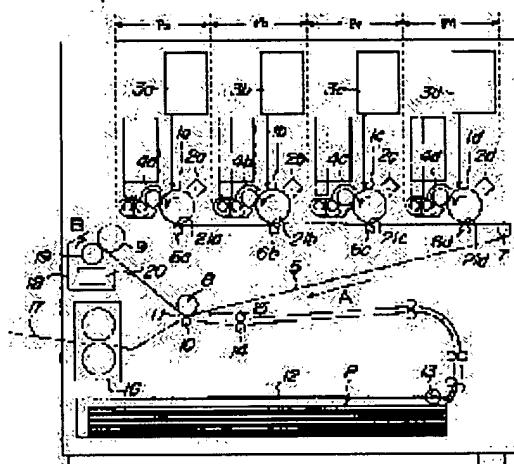
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[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] Two or more image formation means which carry out toner development of the latent image which was charged with an electrification means, carried out selection exposure and formed the surface of two or more image support arranged in parallel with a development means, and carry out the sequential imprint of this toner image at a middle imprint object which moves with a primary imprint means A secondary imprint means to imprint to record material which has a toner image imprinted by said middle imprint object conveyed A transfer residual toner electrification means by which is image formation equipment equipped with the above, and it is charged so that it may have electrification of reversed polarity with a time of negatives being developed by said development means to a toner which remained on said middle imprint object Are the migration direction downstream of said middle imprint object from said secondary imprint means, and it arranges in the upstream rather than said primary imprint means. While said development means recovers a transfer residual toner which remained to said image support after imprinting a toner image primarily to said middle imprint object After imprinting a toner image secondarily to said record material, it is characterized by carrying out reverse transcription of the transfer residual toner which remained on said middle imprint object to said image support, and collecting them with said development means further by electrification by said transfer residual toner electrification means and primary imprint means.

[Claim 2] An electrification means by which the surface of said image support is charged is image formation equipment according to claim 1 characterized by being an impregnation electrification means.

[Claim 3] A primary imprint means by which it is charged to a toner which remained on said middle imprint object is image formation equipment according to claim 1 characterized by being a primary imprint means in an image formation means to imprint a toner image first to a middle imprint object.

[Claim 4] An image formation means to imprint a toner image first to said middle imprint object is image formation equipment according to claim 3 characterized by being what imprints a black toner image.

[Claim 5] A toner used for formation of said toner image is image formation equipment according to claim 1 to 4 characterized by being the toner created by polymerization method.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the image formation equipment which cleans a residual toner to development and coincidence while using two or more still more detailed image support and middle imprint objects about image formation equipments, such as a copying machine, and a printer, facsimile apparatus.

[0002]

[Description of the Prior Art] In recent years, various image output units have been proposed so that improvement in reliability, system expansion, the maintenance free, the man, and the demand of being environment-friendly may increase on the other hand and image formation equipments, such as electrophotography equipment, may fill those demands, although a miniaturization, advanced features, and colorization have been advanced.

[0003] A reduction of the reinforcement of the miniaturization of the whole equipment, ecology correspondence according to waste toner loess especially recently, and a photo conductor drum, and the toner consumption per page sake, By making the cleaning means of the toner which remains to the photo conductor drum side after the toner image imprint to record material use also [means / development] Are called "development coincidence cleaning" or the "cleaner loess" which lost arrangement of the cleaning means as a special-purpose-machine machine. (These are hereafter called "cleaner loess system") image formation equipment has also appeared (JP,59-133573,A --) A 62-203182 official report, a 63-133179 official report, a 64-20587 official report, JP,2-51168,A, a 2-302772 official report, a 5-2287 official report, a 5-2289 official report, a 5-53482 official report, a 5-61383 official report, etc.

[0004] Cleaner loess systems are the direct current voltage which the imprint residual toner of photo conductor drum lifting is made to shift to the development section from the imprint section, and impresses it to toner support in the toner support (a toner supply object, development member) of a development means at the time of the development after degree production process, and a thing which is the potential difference between photo conductor drum surface potentials and which is fogged and are collected according to the picking potential difference.

[0005] According to this, even if there is no cleaning equipment as a special-purpose machine, since an imprint residual toner is recovered by the development means and used for the development after degree production process, a waste toner can be lost. Moreover, since there is no arrangement of the cleaning equipment as a special-purpose-machine machine, the advantage in the field of a space can also be large and equipment can be miniaturized sharply.

[0006] When the globular form toner generated in the polymerization method is used for the above-mentioned cleaner loess system, it has become clear that a good result is obtained. Since in the case of the globular form toner generated by the polymerization method adhesion force to a photo conductor drum, such as ***** and Van der Waals force, becomes small and the transfer residual toner in an imprint production process becomes [the recovery effectiveness of the toner at the time of development

coincidence cleaning] large few, it becomes advantageous to a cleaner loess system.

[0007] And also in the image formation equipment which adopted the cleaner loess system in consideration of reduction of the reinforcement of the miniaturization of the whole equipment, the ecology correspondence by waste toner loess, and a photo conductor drum, and the toner consumption per page, it has two or more photo conductor drums for colorization and improvement in the speed, and looks forward to the appearance of the color picture formation equipment which obtained the color picture on the middle imprint object at the high speed by carrying out the multiplex imprint of the toner image one by one.

[0008]

[Problem(s) to be Solved by the Invention] However, in the image-formation equipment which has two or more image formation units using the cleaner loess system which collects the transfer residual toners of photo conductor drum lifting like the above-mentioned configuration with a development counter, and adopted the middle imprint method, when the middle imprint object cleaner of a cleaning-blade method is used, a superfluous load is applied to a middle imprint object, and there is a problem that where of the torque which drives a middle imprint object becomes high.

[0009] When the load torque to a middle imprint object became high, the passing speed of a middle imprint object became unstable, and when imbalance arose to the load torque by the side of the poor image that registration is confused, and a near side and the back, there was a possibility that the force in case a middle imprint object visits a main scanning direction might become large too much, and the drive of a middle imprint object might become impossible.

[0010] When the globular form toner generated by the polymerization method as a toner was used and it was going to clean sufficient middle imprint object, since it needed to set up greatly the cleaning-blade pressure of a middle imprint object cleaner, such a problem especially had turned into a remarkable problem.

[0011] Moreover, chestnut NARESU in the whole equipment could not become and its configuration which prepares a cleaning device in a middle imprint object, and collects and discards a secondary transfer residual toner was inadequate from an ecology *** viewpoint, even if it adopted the cleaner loess system as the circumference of a photo conductor drum with much trouble.

[0012] The image formation equipment which this invention does not need to solve the above-mentioned technical problem, and the purpose does not need to establish the cleaning device of ***** which was the case where a middle imprint object was used, and does not make high load torque to a middle imprint object is offered.

[0013]

[Means for Solving the Problem] A typical configuration concerning this invention for attaining the above-mentioned purpose Two or more image formation means which carry out toner development of the latent image which was charged with an electrification means, carried out selection exposure and formed the surface of two or more image support arranged in parallel with a development means, and carry out the sequential imprint of this toner image at a middle imprint object which moves with a primary imprint means, In image formation equipment which has a secondary imprint means to imprint to record material which has a toner image imprinted by said middle imprint object conveyed A transfer residual toner electrification means by which it is charged so that it may have electrification of reversed polarity with a time of negatives being developed by said development means to a toner which remained on said middle imprint object Are the migration direction downstream of said middle imprint object from said secondary imprint means, and it arranges in the upstream rather than said primary imprint means. While said development means recovers a transfer residual toner which remained to said image support after imprinting a toner image primarily to said middle imprint object After imprinting a toner image secondarily to said record material, it is characterized by carrying out reverse transcription of the transfer residual toner which remained on said middle imprint object to said image support, and collecting them with said development means further by electrification by said transfer residual toner electrification means and primary imprint means.

[0014] If it is in the above-mentioned configuration, in image formation equipment which adopted a

middle imprint method, without using a cleaning-blade method as a middle imprint object cleaner, it is charged so that it may have TORIBO of reversed polarity with the time of development to a secondary transfer residual toner, and reverse transcription is performed from a middle imprint object to image support, and a development means recovers. For this reason, a problem that torque which a superfluous load is applied to a middle imprint object, and drives a middle imprint object becomes high, The poor image that load torque to a middle imprint object becomes high, passing speed of a middle imprint object becomes unstable, and registration is confused When imbalance arises to load torque by the side of a near side and the back, force in case a middle imprint object visits a main scanning direction becomes large too much, and becomes possible [preventing a problem of a drive of a middle imprint object becoming impossible].

[0015]

[Embodiment of the Invention] Next, the image formation equipment concerning 1 operation gestalt of this invention is explained with reference to a drawing.

[0016] The [1st operation gestalt] The 1st operation gestalt is explained with reference to drawing 1 thru/or drawing 3 . In addition, drawing 1 is outline configuration explanatory drawing of image formation equipment, drawing 2 is explanatory drawing of the shape factor of a toner, and drawing 3 is structure explanatory drawing of a toner.

[0017] Here, the whole image formation equipment configuration is explained first, and the cleaning configuration of a middle imprint object is explained below.

[0018] {the whole image formation equipment configuration} -- two or more image formation units Pa, Pb, Pc, and Pd as an image formation means carry out a ***** sequential array in the migration direction of this belt portion in the upper line side belt portion top of the middle imprint belt 5 as a middle imprint object, and this image formation equipment is arranged, as shown in drawing 1 .

[0019] In each image formation units Pa, Pb, Pc, and Pd, formation of the black image as a color-separation component image of a full color image, a cyanogen image, a yellow image, and a Magenta image is made by each photo conductor drums 1a, 1b, and 1c as image support, and 1d page.

[0020] With this operation gestalt, it sets to each image formation units Pa, Pb, Pc, and Pd.

Electrification means 2a which carries out electrification processing of the photo conductor drums 1a, 1b, 1c, and 1d and this photo conductor drum as image support at homogeneity, respectively, 2b, and 2c, 2d and image exposure means 3a, 3b, 3c, and 3d to form an electrostatic latent image in the electrification processing side of a photo conductor drum, It is the image formation unit of cleaner loess with development means 4a, 4b, 4c, and 4d to develop the formed electrostatic latent image by the toner particle.

[0021] Each color toner image is formed in the above-mentioned image formation unit, the sequential imprint of the toner image is carried out to the middle imprint belt 5 which contacts and rotates to a photo conductor drum by bias impression to the primary imprint rollers 6a, 6b, 6c, and 6d, the toner image further imprinted by the middle imprint belt 5 is secondarily imprinted to record material, and a color picture is obtained.

[0022] (Image support) In each above-mentioned image formation units Pa, Pb, Pc, and Pd, with this operation gestalt, the photo conductor drums 1a, 1b, 1c, and 1d are OPC photo conductors with a diameter [of 30mm], and a length of 300mm, and a rotation drive is carried out in the direction of a clockwise rotation of an arrow head with the process speed (peripheral velocity) of 100 mm/sec.

[0023] The photo conductor drum as image support in the equipment of this operation gestalt becomes a conductive drum base made from aluminum (aluminum base), and its peripheral surface from the photo conductor layer which formed four the 1st layer to layer [4th] layers one by one.

[0024] Here, the 1st layer is an under-coating layer and is a conductive layer with a thickness of 20 micrometers prepared in order to accustom the defect of an aluminum base.

[0025] The 2nd layer is a positive charge impregnation prevention layer, and is an interlayer with a thickness of 1 micrometer by which played the role which prevents negating the negative charge with which the positive charge poured in from the aluminum base was charged on the photo conductor surface, and resistance adjustment was carried out with Amilan resin and methoxymethyl-ized nylon at

the 106 ohm-cm degree.

[0026] The 3rd layer is a charge generating layer, is a layer with a thickness of about 0.3 micrometers which distributed the pigment of a JISUAZO system to resin, and generates a positive negative charge pair by receiving exposure.

[0027] It is charge *****, and the 4th layer distributes a hydrazone to polycarbonate resin, and is a P-type semiconductor. Therefore, the negative charge charged on the photo conductor surface can convey only the positive charge which could not move this layer but was generated in the charge generating layer to the photo conductor surface.

[0028] (Electrification means) With this operation gestalt, the corotron type corona-electrical-charging machine is used electrification means 2a, 2b, and 2c and 2d. He is trying to electrify uniformly the photo conductor drums 1a, 1b, and 1c and 1d surface in abbreviation-700V with this corona-electrical-charging vessel.

[0029] (Exposure means) With this operation gestalt, the image exposure means 3a, 3b, 3c, and 3d did not need the optical path length, but used the LED array as a solid scanner advantageous to the miniaturization of equipment. By carrying out blinking (ON/OFF) control of each these LED arrays [3a, 3b, 3c, and 3d] LED corresponding to the time series electrical-and-electric-equipment digital pixel signal of manuscript image information inputted from the non-illustrated image reader Image exposure is made to a photo conductor drums [rotating / 1a, 1b, 1c, and 1d] electrification processing side, the photo conductor drums 1a, 1b, and 1c and the 1d page surface potential of an exposure bright section decline, and an electrostatic latent image is formed.

[0030] (Development means) The development means 4a, 4b, 4c, and 4d use 2 component MAG brush reversal developer (development counter) with this operation gestalt. It consists of a regulation blade arranged in order to carry out thin layer formation of the magnet roller and developer which have been placed in a fixed position in a development sleeve and a development sleeve on the development sleeve surface as an outline configuration of a developer, a development container which holds the mixture of a nonmagnetic toner particle and a magnetic carrier particle.

[0031] The black toner is made to have held in development means 4a in the image formation unit Pa for blacks, and reversal development is carried out, using as a black image the electrostatic latent image of correspondence in the black image formed in the photo conductor drum 1a page. To development means 4b in the image formation unit Pb, a cyanogen toner is contained similarly, a yellow toner is contained to development means 4c in the image formation unit Pc, a Magenta toner is contained for 4d of development means in the image formation unit Pd, and reversal development is performed by the same method as the case of a black toner.

[0032] (Toner) The toner used for this operation gestalt is a diameter polymerization toner of a nonmagnetic particle 100-120, and whose shape factor SF 2 are the substantial globular forms 100-120, and whose particle size a shape factor SF 1 is 5-7 micrometers including the low softening material manufactured for example, by the suspension-polymerization method five to 30% of the weight.

[0033] If the configuration of a toner approaches a globular form infinite, it is said that imprint effectiveness becomes high. The surface energy of each toner becomes small, a fluidity increases, the adsorption power (reflection force) over a photo conductor drum etc. becomes weaker, and this is considered to become easy to be influenced of imprint electric field.

[0034] In addition, it is the value which shows the rate of the roundness of the configuration of spherical material as shown in drawing 2 (a) in the shape factor SF 1 here, and the square of the maximum length Lmax of the ellipse-like graphic form which projects spherical material on a 2-dimensional plane, and can do it is broken by the graphic form area S, and it is expressed with the value when multiplying by $100\pi/4$. That is, a shape factor SF 1 is [0035]. $SF1 = (Lmax^2/S) \times (100\pi/4)$

[0036] It comes out and defines.

[0037] As shown in drawing 2 (b), a shape factor SF 2 is a numeric value which shows the rate of the irregularity of the configuration of material, breaks by the graphic form area S the square of the perimeter Lp of the graphic form which projects material on a 2-dimensional plane and can do it, and is expressed with the value when multiplying by $100\pi/4$. That is, a shape factor SF 2 is a degree type and

[0038]. $SF2 = (Lp2/S) \times (100\pi/4)$

[0039] It comes out and defines.

[0040] In addition, with this operation gestalt, using Hitachi FE-SEM (S-800), a toner image is sampled to random 100 times, and through an interface, the image information analyzes by introducing into the image-analysis equipment made from NIKORE (LUSEX3), and is computed from a top type.

[0041] The outline block diagram of the above-mentioned polymerization toner is shown in drawing 3. As shown in drawing 3, the polymerization toner t serves as the manufacturing method top globular form. With this operation gestalt, the ester system wax was connoted to the core t1, and the polymerization toner of a configuration of telling styrene-butyl acrylate to the resin layer t2, and telling styrene-polyester to a surface t3 was used. The specific gravity is about 1.05. The reason used as 3 lamination is connoting a wax to a core t1, and since the rise of electrification effectiveness is in drawing by acquiring the offset prevention effect in a fixing production process, and preparing a resin layer in a surface t3, it is actually **(ing) the silica which carried out oil processing for TORIBO stabilization outside at the time of use.

[0042] in addition, TORIBO (Q/M) of the above-mentioned toner used with this operation gestalt -- about -- it is -30 mC/kg (the amount of Q:charges, M: mass).

[0043] (Middle imprint object) The endless-belt object (middle imprint object belt) 5 as a middle imprint object It is made to cross in each image formation unit Pa, Pb, Pc, and Pd bottom between photo conductor drums [of each of this image formation unit / 1a, 1b, 1c, and 1d] inferior surfaces of tongue. **** set-up has been carried out at three rollers, a driving roller 7, the secondary imprint opposite roller 8, and the follower roller 9, and as shown at the arrow head A of drawing 1, a rotation drive is carried out with the peripheral velocity same in the direction of a counterclockwise rotation of ** as the photo conductor drums 1a, 1b, 1c, and 1d.

[0044] As for said middle imprint belt 5, what carried out distributed mixing of a conductive carbon particle, a conductive metal powder, etc. to polyurethane system resin, polyester system resin, polystyrene system resin, polyolefine system resin, poly-butadiene system resin, polyamide system resin, polyimide system resin, polyvinyl chloride system resin, polyethylene system resin, fluorine system resin, etc. is used as a material.

[0045] In this operation gestalt, the thing which made polyimide system resin distribute a carbon particle was used. And the volume-resistivity value has the desirable range of 108 - 1016 ohm-m. When the middle imprint object belt 5 below 107ohm and m is used, it bleeds in an image. The problem of being as imprint effectiveness changing at the time of the image formation from which an image ratio differs **** [and] arises. [that **** arises] When the middle imprint object belt 5 of 1017 or more ohm-m is used, and the potential of the middle imprint object belt 5 becomes large too much at the time of a toner imprint, abnormality discharge occurs between the photo conductor drums 1a, 1b, 1c, and 1d or the record material P, and a poor image is generated. Then, in this operation gestalt, the seamless belt of 100 micrometers in thickness, and volume-resistivity about 1013 ohm-m is used.

[0046] (Primary imprint means) The primary imprint rollers 6a, 6b, 6c, and 6d which constitute a primary imprint means are constituted by the 1st to 4th four roller arranged inside the middle imprint belt 5, respectively.

[0047] 1st primary imprint roller 6a contacts the inferior surface of tongue of photo conductor drum 1a of the image formation unit Pa for blacks on both sides of the upper line side belt portion of the middle imprint object belt 5, and forms primary imprint section 21a. 2nd primary imprint roller 6b contacts the inferior surface of tongue of photo conductor drum 1b of the image formation unit Pb for cyanogen on both sides of the upper line side belt portion of the middle imprint object belt 5, and forms primary imprint section 21b. 3rd primary imprint roller 6c contacts the inferior surface of tongue of photo conductor drum 1c of the image formation unit Pc for yellow on both sides of the upper line side belt portion of the middle imprint object belt 5, and forms primary imprint section 21c. 4th primary imprint roller 6d, a photo conductor drum 1d [of the image formation unit Pd for Magentas] inferior surface of tongue is contacted on both sides of the upper line side belt portion of the middle imprint object belt 5, and 21d of primary imprint sections is formed.

[0048] From non-illustrated imprint bias power supply, with a toner, the imprint bias of reversed polarity is impressed to the each first imprint rollers 6a, 6b, 6c, and 6d, and, thereby, the photo conductor drums 1a, 1b, and 1c and the toner image by the side of 1 d-th page are imprinted electrostatic in the upper line side belt side of the middle imprint object belt 5 in the primary imprint sections 21a, 21b, 21c, and 21d, respectively.

[0049] (Image recording procedure) As for the case of the equipment of this operation gestalt, in primary imprint section 21a of the image formation unit Pa for blacks, a black image is first imprinted by the upper line side belt side of the middle imprint object belt 5 from photo conductor drum 1a page. Subsequently, it imprints so that it may lay on top of the upper line side belt side of the middle imprint object belt 5 by the method that a cyanogen image, a yellow image, and a Magenta image are the same, and synthetic formation of the full color image is carried out.

[0050] In the above-mentioned object for blacks, the object for cyanogen, the object for yellow, and each image formation units Pa, Pb, Pc, and Pd for Magentas, respectively Developers 3a, 3b, 3c, and 3d It is made to serve as a cleaning means to remove the photo conductor drums 1a, 1b, and 1c, the photo conductor drums 1a, 1b, and 1c after imprinting an image from 1d page to the 5th page of a middle imprint object belt, and the transfer residual toner that remained to 1d page. It cleans to development and coincidence and all of each image formation units Pa, Pb, Pc, and Pd are not made to possess the photo conductor drum cleaning machine as a special-purpose-machine machine (cleaner loess system).

[0051] And the middle imprint belt side in which the full color image was formed as mentioned above results in the secondary imprint section 11 formed by rotation of the continuing middle imprint object belt 5 with the secondary imprint opposite roller 8 and the secondary imprint roller 10 as a secondary imprint means. The secondary imprint roller 10 contacts the secondary imprint opposite roller 8 on both sides of a middle imprint object belt, and forms the secondary imprint section, and the imprint bias of reversed polarity is impressed with a toner from non-illustrated imprint bias power supply.

[0052] It is the feed roller with which 12 manipulates a sheet paper cassette and 13 begins to manipulate the record material (imprint material) P from this sheet paper cassette 12. 14 and 15 are resist roller pairs and feed the secondary imprint section 11 with the record material P with which it was fed from said sheet paper cassette 12 to predetermined timing.

[0053] That is, when the point of the full color image formed in this middle imprint object belt side of rotation of the middle imprint object belt 5 reaches the secondary imprint section 11, it is fed with the record material P and the package imprint of the full color image by the side of the 5th page of a middle imprint object belt is carried out to this feed record material P in the secondary imprint section 11.

[0054] It dissociates from the 5th page of a middle imprint object belt, and the record material P which came out of the secondary imprint section 11 receives heat fixing of the image introduced into the fixing unit 16, and is delivered to the tray 17 besides equipment as an image formation object.

[0055] Moreover, the transfer residual toner left behind to the 5th page of a middle imprint object belt at the time of a secondary imprint is charged in reversed polarity with transfer residual toner electrification equipment 18 with the time of the imprint to the 5th page of a middle imprint object belt.

[0056] {the cleaning configuration of a middle imprint object} -- the cleaning configuration of the middle imprint belt 5 as a middle imprint object after imprinting said toner image to the record material P next is explained.

[0057] In this operation gestalt, by electrification by the transfer residual toner electrification means and the primary imprint means, reverse transcription of the transfer residual toner which remained to the middle imprint belt 5 is carried out to photo conductor drum 1a, and they are further collected by development means 4a, and a transfer residual toner electrification means is the rotation direction downstream of the middle imprint belt 5 from said secondary imprint roller 10, therefore it is arranged in the upstream rather than said primary imprint roller 6a.

[0058] This transfer residual toner electrification equipment 18 has the transfer residual toner electrification means 19 with the three-tiered structure of the low resistance sponge layer which consists of acrylic sponge, and the resistive layer which consists of acrylic urethane and the surface mold release layer which consists of a fluororesin. A volume resistivity is [at a resistive layer] 1014 - 1018 ohm-m

in a 107 - 1011 ohm-m surface mold release layer. Moreover, it is made to contact by total pressure 980-2940mN (100-300gf) to the middle imprint object belt 5, and is rotated by the direction of a counter to the direction of the drawing Nakaya mark B, and the hand of cut of the middle imprint object belt 5. The contact pressure of this transfer residual toner electrification means 19 is 1 / 3 - 1/20 of the required contact pressure, when the conventional cleaning blade is made to contact the direct middle imprint belt 5 and is cleaned.

[0059] Moreover, transfer residual toner electrification equipment 18 equips the transfer residual toner electrification means 19 also with the high voltage power supply 20 for impressing high pressure, and that absolute value is constituted from this high voltage power supply 20 by the toner and reversed polarity which were developed so that the DC bias of 1-3kV of abbreviation (a current value is abbreviation 5-40microA at an absolute value) may be outputted. Since the effect of being re-charged will increase TORIBO of a transfer residual toner in homogeneity if AC bias is superimposed as bias to output, although only a DC bias is [but] good as mentioned above, it is desirable.

[0060] Reverse transcription of the secondary transfer residual toner on the middle imprint belt 5 is carried out, and cleaning of the middle imprint belt 5 concerning this operation gestalt returns it to the primary imprint and coincidence from photo conductor drum 1a of the image formation unit Pa of the beginning of the hand of cut of the middle imprint belt 5 after secondary imprint termination to the middle imprint belt 5 at photo conductor drum 1a, and has the feature at the place collected in development means 4a of the image formation unit Pa.

[0061] The mechanism is explained. The toner image formed on the middle imprint belt 5 is imprinted with the electrification polarity of this toner image by the record material P sent to the secondary imprint section 11 by the powerful electric field formed of the secondary imprint bias of reversed polarity.

[0062] As for the secondary transfer residual toner which remains on the middle imprint belt 5, without the record material P imprinting, at this time, the electrification polarity of normal has many which have been charged in reversed polarity. However, a part of toner in which it is not reversed by the electrification polarity of normal and reversed polarity, it is neutralized, and no secondary transfer residual toners have a charge, and toner which is maintaining the electrification polarity (it sets in this operation gestalt and is negative polarity) of normal also exist. With transfer residual toner electrification equipment 18, all the secondary transfer residual toners that remain on the middle imprint belt 5 are re-charged with the electrification polarity of normal to such a secondary transfer residual toner in reversed polarity (it sets in this operation gestalt and is straight polarity).

[0063] Next, with the electrification polarity of normal, when the re-charged secondary transfer residual toner receives the same imprint electrification as the usual imprint production process in reversed polarity in the primary imprint section of the first image formation unit Pa, reverse transcription of the transfer residual toner on a middle imprint belt will be carried out at a photo conductor drum side, and a middle imprint belt 5 surface top will be cleaned.

[0064] The secondary transfer residual toners by which reverse transcription was carried out to the photo conductor drum side are collected by development means 3a in the development section of the image formation unit Pa, within development means 3a, again, will be re-charged in the electrification polarity of normal, and will be reused.

[0065] Since the secondary transfer residual toner on the middle imprint belt 5 exists, respectively at this time, black, cyanogen, yellow, and a Magenta Although the tint of cyanogen, yellow, and a Magenta will be worn greatly and will cause a poor image if the development means of cyanogen, yellow, and the image formation unit that performs image formation of a Magenta is made to recover When development counter 4a of the image formation unit Pa of black is made to collect as shown in this operation gestalt, since it is hardly conspicuous even if the black color is colorless from the first and the toner of other colors mixes in black development counter 4a somewhat, it does not result in a poor image.

[0066] As explained above, while making a middle imprint belt generate a superfluous drive load with a middle imprint belt cleaner by considering as the above-mentioned configuration was lost, since reclamation of the secondary transfer residual toner generated at the time of the secondary imprint to

record material from a middle imprint belt also became possible, construction of a perfect KURINA loess system was attained.

[0067] The [2nd operation gestalt] The 2nd operation gestalt of this invention is explained with reference to drawing 4 below. In addition, drawing 4 is outline configuration explanatory drawing of the image formation equipment in the 2nd operation gestalt, and gives the same sign to the same member as the 1st operation gestalt mentioned above.

[0068] As shown in drawing 4, it has composition in which two or more image formation units Pa, Pb, Pc, and Pd met and carried out the sequential array and which they arranged in the migration direction of this belt portion in the upper line side belt portion top of the middle imprint belt 5 like the 1st operation gestalt mentioned above also in this operation gestalt. And in each image formation units Pa, Pb, Pc, and Pd, formation of the black image as a color-separation component image of a full color image, a cyanogen image, a yellow image, and a Magenta image is made by each photo conductor drums 101a, 101b, and 101c and 101d page from the rotation direction upstream of the middle imprint belt 5 at order.

[0069] Moreover, also in this operation gestalt, it sets to each image formation units Pa, Pb, Pc, and Pd. The electrification means 102a, 102b, 102c, and 102d which carry out electrification processing of the photo conductor drums 101a, 101b, 101c, and 101d and this photo conductor drum as image support at homogeneity, respectively, and image exposure means 3a, 3b, 3c, and 3d to form an electrostatic latent image in the electrification processing side of a photo conductor drum, It is the image formation unit of cleaner loess with development means 4a, 4b, 4c, and 4d to develop the formed electrostatic latent image by the toner particle.

[0070] However, unlike the corona-electrical-charging means shown in the 1st operation gestalt which an electrification means to electrify a photo conductor drum in this operation gestalt mentioned above, the electrification means of an impregnation electrification method is used also in a contact electrification means to have advantages, such as ozone loess and low power consumption, and the contact electrification means. Hereafter, a different portion from the 1st operation gestalt is explained.

[0071] Although the photo conductor drums 101a, 101b, 101c, and 101d are OPC photo conductors with a diameter [of 30mm], and a length of 300mm also in this operation gestalt in each above-mentioned image formation units Pa, Pb, Pc, and Pd and a rotation drive is carried out with the pro SESUSU bead (peripheral velocity) of 100 mm/sec at the clockwise rotation of an arrow head, lamination differs from the photo conductor used for the above-mentioned 1st operation gestalt so that it may mention later.

[0072] That is, the photo conductor drums 101a, 101b, 101c, and 101d as image support in the equipment of this operation gestalt become a conductive drum base made from aluminum (aluminum base), and its peripheral surface from the photo conductor layer which comes to form the five following layers one by one. About the 1st to 4th layer, it is the same as that of the above-mentioned 1st operation gestalt. And with this operation gestalt, it has the charge impregnation layer as the 5th layer.

[0073] Said layer [5th] charge impregnation layer is a coating layer of the material which distributed SnO₂ ultrafine particle as a conductive particle to the binder of insulating resin. It is the coating layer of the material which distributed 70 percentage by weight of SnO₂ particles with a particle size of 0.03 micrometers which specifically doped and formed into low resistance the antimony which is the electric conduction filler of light transmission nature to insulating resin (electric-conduction-izing) to resin. Thus, coating of the prepared coating liquid is carried out to 3 micrometers in thickness by the coating method with suitable dipping coating method, spray coating method of construction, roll coat coating method, beam coat coating method, etc., and it is considering as the charge impregnation layer.

[0074] Or the photo conductor (an amorphous silicon drum, a-Si drum) which has the surface layer which consists of an amorphous substance of silicon is used similarly.

[0075] The photo conductor as the charged body-ed shall have the low resistive layer of surface electrical resistance 10¹¹ - 10¹⁶ ohm-m.

[0076] Moreover, the electrification means 102a, 102b, 102c, and 102d in this operation gestalt are magnetic sleeve rotation type brush contact live-part material.

[0077] as an outline configuration, it becomes the peripheral face of the magnet roller of immobilization

with a diameter of 16mm which consists of S-Nof each 2 pole (flux density is about 1000 gauss of each), the sleeve which consists of nonmagnetic SUS material which rotation freedom was made to attach outside this magnet roller, and this sleeve from the magnetic brush layer of the magnetic particle which carried out adhesion maintenance by the magnetism of a magnet roller.

[0078] As a magnetic particle which makes a magnetic brush layer constitute, the thing of 1x104 - 1x1012 ohm-m has [10-100 micrometers and saturation magnetization / 4 - 50 A-m2/kg and resistance] desirable mean particle diameter, and when it takes into consideration that the defect of an insulation like a pinhole exists in a photo conductor drum, it is desirable to use the thing of 1x106 or more ohm-cm. After an area of base puts 2g of magnetic particles into the metal cel of 2 228mm, the resistance of a magnetic particle was weighted by 6.6kg/cm2, and has impressed and measured voltage to 100V.

[0079] Since it was better to use what has resistance small as much as possible for receiving the electrification engine performance, the peripheral face of a sleeve was made to carry out 40g MAG adhesion of this using the thing of the mean particle diameter of 25 micrometers, saturation magnetization 40 A-m2/kg, and resistance 5x108 ohm-m in this operation gestalt, and the magnetic brush layer was made to form.

[0080] The object which coated with resin magnetite simplex-tableaux sides, such as a resin carrier which distributed the magnet as a magnetic material, and distributed and formed carbon black into resin as a configuration of a magnetic particle for electric-conduction-izing and resistance adjustment, or a ferrite, and performed resistance adjustment is used.

[0081] An above-mentioned brush contact electrification means [magnetic / 102a, 102b, 102c, and 102d] magnetic brush layer is contacted to a photo conductor drum side, and is arranged. Width of face of the contact nip section of a magnetic brush layer and a photo conductor drum is set to 6mm.

[0082] And the predetermined electrification bias Vdc is impressed to a sleeve from a non-illustrated electrification bias impression power supply. It is that the hand of cut of a photo conductor drum makes the rotation drive of the sleeve carry out in the direction of a clockwise rotation used as the direction of a counter (hard flow) by peripheral-velocity 150 mm/sec in the contact nip section with a photo conductor drum. A rotation photo conductor drum side is ****(ed) in the magnetic brush layer to which electrification bias was impressed, and the surface of the photo conductor layer of a photo conductor drum is uniformly charged primarily by the impregnation electrification method in desired potential.

[0083] If contact live-part material, such as such a magnetic brush, is used unlike the 1st operation gestalt mentioned above Since a primary transfer residual toner and a secondary transfer residual toner are once held at contact live-part material, are breathed out gradually and come to be recovered by the development counter Since a lot of transfer residual toners exist in photo conductor drum lifting at the time of image exposure, and the problem of causing trouble to the next image formation can be avoided and recovery with a development counter comes to be performed smoothly, it is desirable.

[0084] As well as contact electrification and the 1st operation gestalt mentioned above by applying the cleaning device of a middle imprint object to the image formation equipment which used the impregnation electrification method especially as above primary electrification means While making a middle imprint object generate a superfluous drive load with a middle imprint object cleaner is lost, reclamation of the secondary transfer residual toner generated at the time of the secondary imprint to record material from a middle imprint object also becomes possible, and construction of a perfect KURINA loess system of it is attained.

[0085]

[Effect of the Invention] Since the toners which remained on the middle imprint object were collected for the development means as mentioned above, this invention The problem that the torque which a superfluous load is applied to a middle imprint object, and drives a middle imprint object becomes high, The poor image that the load torque to a middle imprint object becomes high, the passing speed of a middle imprint object becomes unstable, and registration is confused When imbalance arises to the load torque by the side of a near side and the back, the force in case a middle imprint object visits a main scanning direction becomes large too much, and becomes possible [preventing the problem of the drive of a middle imprint object becoming impossible].

[0086] When the globular form toner especially generated by the polymerization method as a toner was used, the remarkable effect could be acquired, and construction of a perfect cleaner loess system was further attained by also collecting secondary transfer residual toners and reusing them in a black image formation unit, without generating serious image evil.

[Translation done.]

*** NOTICES ***

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is outline configuration explanatory drawing of image formation equipment.

[Drawing 2] It is explanatory drawing of the shape factor of a toner.

[Drawing 3] It is structure explanatory drawing of a toner.

[Drawing 4] It is outline configuration explanatory drawing of the image formation equipment in the 2nd operation gestalt.

[Description of Notations]

P -- Record material

Pa, Pb, Pc, and Pd -- image formation unit

1a, 1b, 1c, and 1d -- Photo conductor drum

2a, 2b, and 2c and 2d -- Electrification means

3a, 3b, 3c, and 3d -- Image exposure means

4a, 4b, 4c, and 4d -- Development means

5 -- Middle Imprint Belt

6a, 6b, 6c, and 6d -- Primary imprint roller

7 -- Driving Roller

8 -- Secondary Imprint Opposite Roller

9 -- Follower Roller

10 -- Secondary Imprint Roller

11 -- Secondary Imprint Section

12 -- Sheet Paper Cassette

13 -- Feed Roller

14 15 -- Resist roller pair

16 -- Fixing Unit

17 -- Tray

18 -- Transfer Residual Toner Electrification Equipment

19 -- Transfer Residual Toner Electrification Means

20 -- High Voltage Power Supply

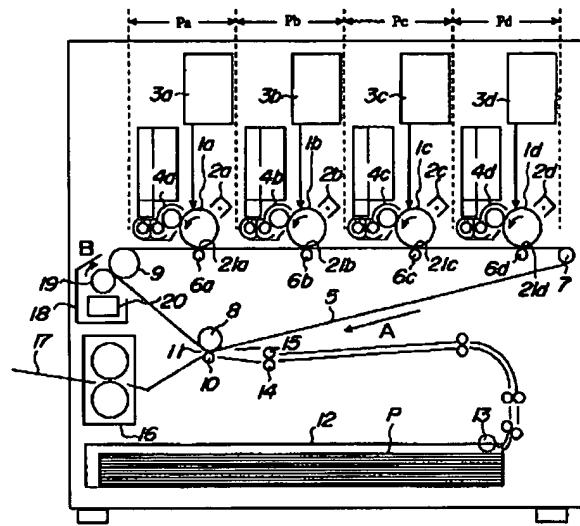
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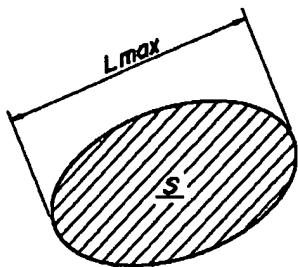
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DRAWINGS

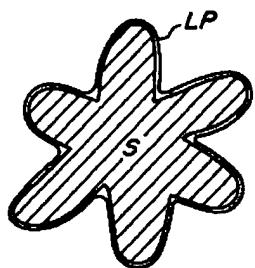
[Drawing 1]**[Drawing 2]**

(a)



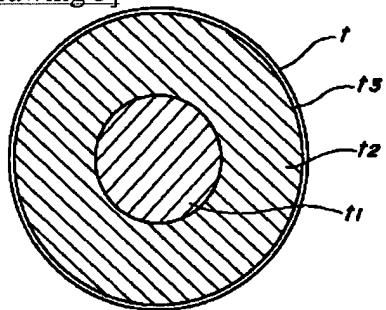
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(b)

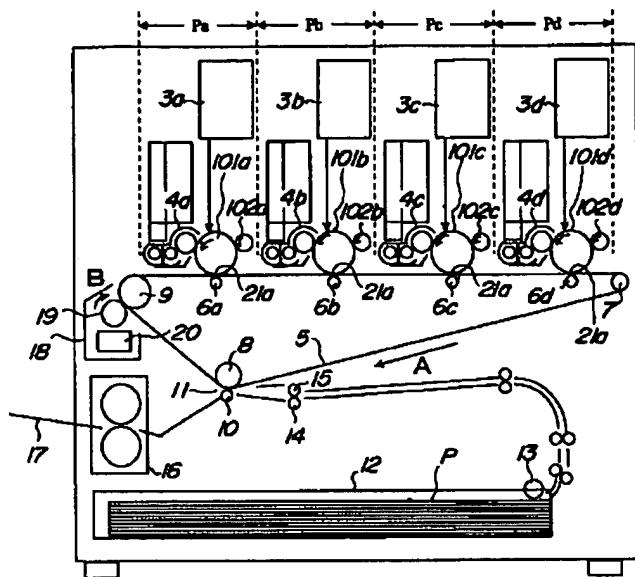


$$SF2 = \frac{LP^2}{S} \times \frac{\pi}{4} \times 100$$

[Drawing 3]



[Drawing 4]



[Translation done.]